

The Bare Bones

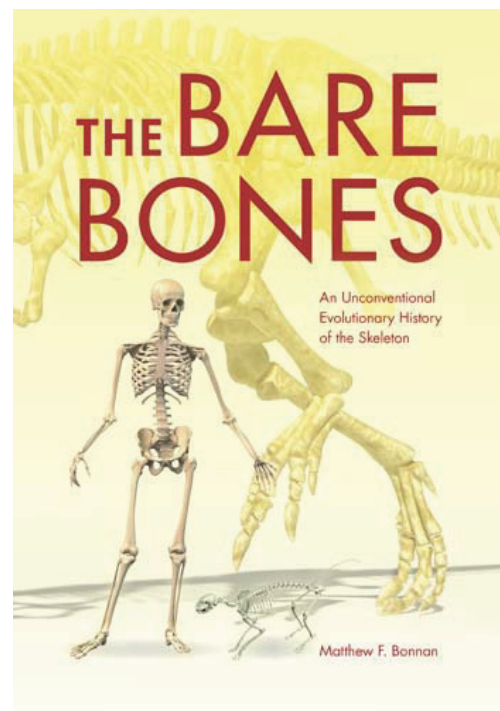
Book reviewed by Shaena Montanari

Matthew F. Bonnan, 2016, Indiana University Press. 528 pages, ISBN: 0253018323
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No bones about it, a text like *The Bare Bones* was sorely needed in the popular literature of vertebrate paleontology. Matthew Bonnan's tome on the evolution, form, and function of the vertebrate skeleton may seem daunting in size, but it is written in an enjoyable and readable fashion that will absolutely delight all sorts of readers from expert to soon-to-be-expert (and anyone will be, once they finish this book). His familiar use of entertaining analogies and stories make the daunting job of understanding the entire history of vertebrate evolution actually manageable for anyone who picks up this book—no easy task.

The Bare Bones is divided into seven overarching parts and 21 chapters spanning the basics of evolution and vertebrate body plans to detailed investigations of the comparative anatomy and physiology of all major vertebrate groups. The tagline for this book is “an unconventional evolutionary history of the skeleton”, because Bonnan takes a fresh approach to comparative anatomy, a topic that can sadly be dry and overwhelming at times. His vast knowledge and passion for the subject can be found on every single page and, along with being educational, is also truly inspiring.

Chapter 1 of Part 1 begins in the advertised “unconventional” method when Bonnan uses an extended analogy of car parts to describe different aspects of anatomy and evolution. This is a fun and clear way to describe in familiar terms ideas like “date of first appearance” as a “date of production” to non-experts. Chapter 2 is a brief yet clear overview of topics that crop up in every evolution course such as DNA, natural selection, and even



some plate tectonics and how bones become fossils.

After the groundwork has been laid down, Part 2 starts off talking about the basic vertebrate “chassis” (the car analogies do continue through the book) and the very basics of vertebrate life. While Chapter 3 discusses what the vertebrate common ancestor would have looked like (squishy), Chapter 4 jumps in to the bony chassis and the advent of bones in the fossil record.

Part 3 focuses on the evolution of jaws, specifically in fish. Chapter 5 elucidates the beginnings of the jaws, and Chapter 6 discusses early jawed fish like placoderms and chondrichthyans. Chapter 7 and 8 cover actinopterygians and sarcopterygians with detailed explanations of typically tricky subjects like the ever-complicated fish skull. In these chapters about jaws and throughout the rest of the text, Bonnan commonly delves into the physics of the skeleton and describes the basic mechanics behind motion, which is a unique and refreshing approach to describing the function of certain anatomical features.

Chapter 9 kicks off Part 4, with Bonnan describing the basics of the tetrapod “chassis.” It opens with a discussion of the actual physical changes for eating, seeing, and moving needed in the tetrapod body plan to survive outside of water. Chapter 10 focuses on the transitional skeleton of the most basal tetrapods and how changes to fins and pectoral girdles allowed them to walk on land. Something I enjoyed about these chapters in particular is a discussion of these anatomical features in an environmental context, which can often be lacking from a purely comparative anatomical standpoint. Chapter 11 finally moves out of the water and onto the land with the exploration of the amphibian “chassis.” A comprehensive overview of these “tetrapods living a double life” is presented, including their unique reproductive characteristics. This part finishes up with Chapter 12, a primer on the amniote body plan and egg, focusing on some of the earliest true amniotes adapted to terrestrial life.

Part 5 is aptly called “Deep Scaly I” and leads into discussions of modern lizards and the tuatara in Chapter 13. Chapter 14 covers more early reptiles and turtles, while Chapter 15 finishes off Part 5 with snakes and “sea dragons”, meaning Sauropterygia and Ichthyosauria. Part 6, “Deep Scaly II”, has three chapters covering the vast range of archosaur body plans. Chapter 16 contains anatomical explanations of the modern archosaurs: crocodylians and modern birds (Neornithes). Chapter 17 is part II of the archosaur “chassis”, but focuses mainly on the posture of archosaurs and the mechanics of their movements and gait. The final “scaly” chapter, Chapter 18 (part III of the archosaur body plan), goes in depth on the anatomy of pterosaurs, dinosaurs, and the origins of birds.

The final section, Part 7, is all about mammals. This part, “Overcome by fur” as Bonnan calls it, starts with the basic mammalian “chassis” in Chapter 19 as a primer on all things furry and synapsid. Chapter 20 focuses on the evolution of the mammalian body plan from early non-mammalian synapsids to cynodonts to mammaliforms. The last chapter, 21, delves into the anatomical specializations that make mammals unique like big brains, milk glands, and specialized teeth. And so ends this exquisitely detailed and entertaining exploration into almost 500 million years of evolution covering the beginnings of bone all the way to crown group mammals.

This book will serve as a great reference and text in any undergraduate or graduate comparative anatomy class. It includes small cladograms before every chapter that help orient the reader to the vertebrate tree of life. There are a myriad of diagrams that illustrate many general members of the groups being described, all created by Bonnan himself. The color plates are also a helpful addition to his vivid descriptions of all body plans. Periodically referenced throughout the book are “cards of time” that represent the sequence of appearance of vertebrate groups throughout the fossil record. These cards appear in the appendix and could potentially be used in an interactive way with students when teaching a course on these topics.

I will absolutely recommend this book to all paleontologists and biologists who teach a class on organismal evolution and anatomy as accessible reading for students being introduced to these subjects for the first time. Overall, the major strength of this relatively jargon-free book is the attention to detail paid to evolution and the basics of body plans. Bonnan does not just plainly describe different forms, but instead focuses on what makes each group unique, and how different body plans fit into the grand scheme of vertebrate evolution. The ability of Bonnan to step back and fit each piece of vertebrate anatomy and physiology into a broad comparative framework is one of the finest and clearest ways I have ever seen this material presented. However, I would recommend this book not just for relative beginners but also for experts, as it is chock-full of so many fascinating tidbits about a stunning array of creatures that there is something for everyone to learn inside these pages.